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21st century learning



GERLINDE OLVERA, M.ED., JENNIFER ELKINS and JOHN.R.WALKUP, PH.D.

Depth of Knowledge in the 21st Century

As a principal of (fictitious) Memorial Junior High, and an observer of classroom sessions on a regular basis, no one can tell Jim more about the different teaching styles employed in his school. Although he notes the contrast in styles from one teacher to the next, he often wonders about the effectiveness of each approach. "What separates one teacher from the rest?"

To begin the day, Jim steps into a math class taught by Lori, a relatively new arrival. Her students are quietly poring over their worksheets. There is no talking. They have few questions. Jim peers over the shoulder of a student. "This is not a test," he thinks to himself. "But they are calculating the mean and median over and over again.

Sheila's class is noisy almost to the point of being chaotic. Students are talking in small groups and seem to be reveling in lively discussions. He investigates further by asking one group of students what they are doing. "We're supposed to buy a house in a neighborhood and we have to decide whether the mean, median or mode is the most important thing to know. When we started, we all picked the mean. But Bill Gates has now moved into the neighborhood. Most of us now think the median is better, but we're having a hard time saying why." Clearly, the students are busy working on a solution to a rather complex problem.

Both sessions correlate to the same grade level and feature the same topic. However, the teaching strategies used in each class differ. The students in one classroom are prompted to recall facts and procedures while the students in the other classroom are encouraged to apply their learned knowledge to solve complex problems featuring real-world relevance.

Clearly, the students in Sheila's class are learning beyond sheer knowledge. They are interacting with one another on an academic, as well as social level, therefore thinking outside the usual parameters to find a solution acceptable to their group.

As Jim steps out of the classroom, he recalls an email he received from a colleague about 21st century skills. It is still in his inbox:

While the “three Rs” are still fundamental to any new workforce entrant’s ability to do the job, employers emphasize that applied skills like teamwork/ collaboration and critical thinking are “very important” to success at work.

Rick’s eighth-grade English class looks much like Sheila’s math class, with students arguing over academic content in small formal groups. “The teacher has asked us to use our poetry skills to analyze why BASF’s motto is so popular. James is responsible for line length, Annie is looking at repetition. I am working on rhythm, but I’m not getting anywhere yet. When we’re done, Hector is supposed to talk about how important poetry skills are in marketing. We think we know already.”

“I’m glad our English department took the recent 21st-century skills training to heart,” Jim thinks. “I guess 21st-century skills aren’t just about math and science.”

Why Incorporate 21st Century Skills in the Classroom?

Ken Kay, the president of Partnership for 21st Century Skills, stated in 2007 that “at this pivotal moment in our nation’s history, legislators and policymakers must focus on the outcomes we know to produce graduates capable of competing in the 21st century and forging a viable economic future.”

Through his work with the business community, he has learned that there is no shortage of employees that are technically proficient, but too few employees that can adequately communicate and collaborate, innovate and think critically. So, rather than simply equating 21st century skills with technical prowess, educators need to expand their understanding of such skills to increasingly emphasize preparing students to think on their feet, communicate effectively and value the ideas of others.

Although myriad characteristics of 21st-century skills appear prominently in the literature, we can highlight three in particular:

- ***Imagination and creativity*** — Organizations need employees that can generate new ideas and find clever solutions to problems previously held to be difficult or even insurmountable.
- ***Cooperation*** — Employees in the 21st century will need to work globally as team players, drawing on the strengths of colleagues to create a powerful whole that can overcome individual weaknesses.
- ***Analytical reasoning*** — Good decision-making involves the ability to analyze information, note relationships, formulate plans and intelligently predict results.

Students will not learn these skills on their own; most will not even learn them at home. For students to meet the expectations of the 21st century, teachers must incorporate these skills into their classrooms.

Teaching 21st Century Skills

Technology already provides students with instant access to facts, which allows teachers to place less emphasis on memorization and focus more on higher-order skills such as analysis, synthesis and evaluation. Of course, sound pedagogy should be founded on the solid ground of content knowledge. However, as noted psychologist, Jerome Bruner wrote, “We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for

himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process, not a product.” Social negotiation and interaction are crucial elements in acquiring knowledge, encouraging interchanges of ideas, and deepening the understanding of learned knowledge.

Lori’s teaching style promotes a memorization of facts and procedures that emphasizes low-level content and procedural knowledge. However, the students in Sheila’s classroom continually enhance and solidify their content knowledge by solving relevant and complex problems in groups, which allows them to communicate and practice their analytical and critical reasoning skills. The educational community cannot assume that students are naturally born with an aptitude for these skills. Teachers must challenge students with well crafted lessons to meet their needs.

The depth-of-knowledge levels of Norman Webb’s depth-of-knowledge (DOK) levels constitute a system that addresses how to teach these skills. Depth of knowledge is a scale of cognitive demand that reflects the complexity of activities that teachers ask students to perform.

- **DOK-1. Recall** — Recall or recognition of a fact, information, concept, or procedure
- **DOK-2. Basic Application of Skill/Concept** — Use of information, conceptual knowledge, follow or select appropriate procedures, two or more steps with decision points along the way, routine problems, organize/ display data
- **DOK-3. Strategic Thinking** — Requires reasoning, developing a plan or sequence of steps to approach problem; requires some decision making and justification; abstract and complex; often more than one possible answer
- **DOK-4. Extended Thinking** — An investigation or application to real world; requires time to research, think, and process multiple conditions of the problem or task; non-routine manipulations, across disciplines/content areas/multiple sources Level 1 of DOK is the lowest level and requires students to recall or perform a simple process. As DOK increases toward the highest (fourth) level, the complexity of the activity moves from simple recall problems to increasingly difficult and teacher independent problem-solving classroom activities, as well as real-world applications. As students are prompted to work within the realms of higher DOK levels, they will learn to independently employ higher-level thinking skills.

Preparing Students for 21st Century Skills with Depth of Knowledge

Depth of knowledge differs from the ubiquitous Bloom’s Taxonomy. There is no one-to-one mapping between the two levels because the role of each rigor model is distinct. Bloom’s Taxonomy, for instance, more closely describes the type of thinking required to answer a question. On the other hand, depth of knowledge correlates to the level of understanding required of students to complete an activity. For example, the solving of a linear equation lies at third order (apply) in Bloom’s Taxonomy, but only the lowest level of depth of knowledge.

Depth of knowledge offers some advantages over Bloom’s Taxonomy for planning lessons and choosing instructional techniques. By increasing the DOK levels of activities, teachers can teach students to adapt to challenges, work cooperatively and solve problems on their own. Whereas Level 1 of DOK prompts students to recall or reproduce, Levels 3 and 4 require students to work without the constant supervision of teachers. Usually students work on higher DOK activities in groups, communicating with one another to solve challenging problems and freely offering their own ideas.

The teacher's role at higher DOK levels is therefore to facilitate, not simply dispense the acquisition of knowledge. Applying increasing DOK levels to classroom settings allows teachers and students to grow into their new roles. As activities increase in complexity, teachers guide the students to make their own decisions. Consequently, students learn to become analytical and critical thinkers, independent problem solvers, experts at communicating with others, and socially astute learners — the “soft skills” needed to become successful members of the 21st century.

Peer and Administrative Support

It may seem daunting to establish a learning environment that fosters 21st century skills.

However, sufficient support from peers and administration promote the necessary teacher collaboration needed to implement a curriculum designed to teach students these higher level thinking skills.

The school day has ended at Memorial Junior High School. Jim asks the teachers for their thoughts.

“Sure, I could just ask them to calculate the mean, like on the state test,” states Sheila. “But their future employers will want more than that. They will ask them for their opinions, and their opinions will require such skills as analyzing and predicting. They will need to confer with colleagues. I figure my students had better know these skills. I put them in groups because that is the environment they will face in the future.”

Rick weighs in next. “The BASF activity ramped up depth of knowledge to the third level. At higher DOK levels, my students need group discussion and longer wait time. I used to work in marketing, and I know for a fact that teamwork and cooperation are huge. So, they need to learn to handle higher DOK activities now, rather than on the job.”

Lori is at first uncomfortable, feeling that her teaching performance is gradually poking through the discussion. “You must not have liked what you saw in my class today.” But the others in the room quickly dissuade her of that notion. “You do a lot of great things, but I would urge you to consider some of the techniques we just discussed,” assures Jim.

“After all, it isn't about what happened today. It's about what will take place tomorrow, next week and next year.”

Working on creating activities in such peer groups enables teachers to learn and articulate while planning for lessons that promote high expectations and cognitively challenging curriculum. In addition, administrators need to provide ongoing support for their teachers in order to empower teachers to succeed in this endeavor. Administrative leadership must mentor and assist teachers in providing the enthusiasm and motivation to continuously teach lessons that promote high student expectations and cognitively challenging lessons.

Although some will remain stubborn, Jim appreciates his teachers and their willingness to improve. “A good crew,” he thinks to himself. “A professional crew.” Jim gazes at the students lining up for their bus rides home. Despite their struggles and antics, he realizes that 20 years from now they will be assuming the controls. “What will the world be like then?” he wonders. “What will become of them?”

Gerlinde Olvera, Jennifer Elkins and John R. Walk-up are curriculum specialists for The Standards Company LLC , a company that specializes in the analysis of collected student work for evidence of cognitive rigor and standards alignment. For information visit www.standardsco.com.

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